Influenza Virus Vaccine
2016-2017 Strain Selection

Vaccines and Related Biological Products Advisory Committee (3/4/2016)

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Purpose of Today’s VRBPAC Committee Discussion

- Review influenza surveillance and epidemiology data, antigenic characteristics of recent virus isolates, serological responses to current vaccines, and the availability of candidate vaccine strains and reagents

- Make recommendations for the strains of influenza A (H1N1 and H3N2) and B viruses to be included in 2016-2017 influenza vaccines licensed for use in the United States
Types of Analyses Used for Vaccine Strain Selection

- Epidemiology of circulating strains *(CDC)*
  - Surveillance data from U.S. and around the world

- Antigenic relationships among contemporary viruses and candidate vaccine strains *(CDC/DOD/CBER)*
  - Hemagglutination inhibition (HI) tests using post-infection ferret sera
  - HI tests using panels of sera from humans receiving recent inactivated influenza vaccines
  - Virus neutralization tests
  - Antigenic cartography
  - Phylogenetic analyses of HA and NA genes
  - Vaccine effectiveness
Key Challenges for Vaccine Strain Selection

- Vaccine effectiveness depends on match between the hemagglutinin (HA) of the vaccine and the HA of circulating strains of virus
  - Antigenic drift of HA continuous for influenza A and B
  - Antibody to HA correlated with vaccine efficacy

- Timelines for influenza vaccine production are relatively fixed
  - Strain selection in February/March necessary for availability of vaccine for subsequent northern hemisphere winter (influenza season)
  - Manufacturers typically begin production of monovalent of one strain before strain selection recommendations are made (at risk)

- Availability of reference strains (candidate vaccine viruses) suitable for vaccine manufacture
  - Vaccine production depends on growth properties of strains used for manufacture
  - Strain-specific reagents needed for potency determination (inactivated and recombinant protein vaccines)
# Seasonal Influenza Vaccine Production Timetable

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Trivalent and Quadrivalent Seasonal Influenza Vaccines

- Two antigenically distinct lineages of influenza B co-circulate
  - Represented by B/Victoria/2/87 and B/Yamagata/16/88

- Both trivalent and quadrivalent influenza vaccines now available
  - 4 quadrivalent vaccines currently licensed in U.S.

- Current process for selecting appropriate B strains for inclusion in trivalent and quadrivalent vaccines similar to procedure for trivalent vaccine recommendation
  - WHO and VRBPAC review and make recommendations for each formulation – trivalent and quadrivalent
Review of the 2015-2016 Seasonal Influenza Vaccine Strain Composition

- VRBPAC strain selection – March 4, 2015
- Committee recommended the following strains for inclusion in U.S. 2015-2016 trivalent influenza vaccines
  - A/California/7/2009 (H1N1)pdm09-like virus
    - No change from the 2014-2015 vaccine recommendation
  - A/Switzerland/9715293/2013 (H3N2)-like virus
    - Change from the A/Texas/50/2012 (H3N2)-like virus vaccine recommendation
  - B/Phuket/3073/2013-like virus (B/Yamagata lineage)
    - Change from the B/Massachusetts/2/2012-like virus vaccine recommendation
- For manufacturers producing a quadrivalent influenza vaccine, the Committee recommended a second B strain
  - B/Brisbane/60/2008-like virus (B/Victoria lineage), previously recommended for quadrivalent vaccines in 2014-2015
WHO Recommendations for Influenza Vaccine Composition
Southern Hemisphere: 2016

- WHO recommendation – 9/24/2015

- Recommended that the following viruses be used for trivalent influenza vaccines in the 2016 influenza season (SH winter):
  - an A/California/7/2009 (H1N1)pdm09-like virus
  - an A/Hong Kong/4801/2014 (H3N2)-like virus
  - a B/Brisbane/60/2008-like virus (B/Victoria lineage)

- It is recommended that quadrivalent vaccines containing two influenza B viruses contain the above three viruses and a B/Phuket/3073/2013-like virus (B/Yamagata lineage vaccine virus)
WHO Recommendations for Influenza Vaccine Composition Northern Hemisphere: 2016-2017

- WHO recommendation – 2/25/2016

- Recommended that the following viruses be used for trivalent influenza vaccines in the 2016-2017 influenza season (NH winter):
  - an A/California/7/2009 (H1N1)pdm09-like virus
    - No change from 2015-2016 NH
  - an A/Hong Kong/4801/2014 (H3N2)-like virus
    - Change from 2015-2016 NH, but same as 2016 SH recommendation
  - a B/Brisbane/60/2008-like virus (B/Victoria lineage)
    - Change from 2015-2016 NH recommendation, previously recommended for quadrivalent vaccines

- Recommended that quadrivalent vaccines containing two influenza B viruses contain the above 3 viruses and a B/Phuket/3073/2013-like virus (B/Yamagata)
  - Previously recommended for trivalent vaccines

- As in previous years, national or regional control authorities approve the composition and formulation of vaccines used in each country
Committee Discussion

Which influenza strains should be recommended for the antigenic composition of the 2016-2017 influenza virus vaccine in the U.S.?
Options for Strain Composition for 2016-2017 Trivalent Influenza Vaccines

- **Influenza A (H1N1)**
  - Recommend an A/California/7/2009 (H1N1)pdm09-like virus (current vaccine strain)
  - Recommend an alternative H1N1 candidate vaccine virus

- **Influenza A (H3N2)**
  - Recommend an A/Hong Kong/4801/2014 (H3N2)-like virus
  - Recommend an alternative H3N2 candidate vaccine virus

- **Influenza B**
  - Recommend a B/Brisbane/60/2008-like virus (B/Victoria lineage)
  - Recommend an alternative candidate vaccine virus from the B/Victoria lineage
  - Recommend a candidate vaccine virus from the B/Yamagata lineage
Options for Strain Selection for the 2\textsuperscript{nd} Influenza B Strain in a Quadrivalent Influenza Vaccine

- **Influenza B**
  - Recommend inclusion of a B/Phuket/3073/2013-like virus (B/Yamagata lineage)
  - Recommend an alternative candidate vaccine virus from the B/Yamagata lineage
Voting Questions for the Committee

1. For the composition of the trivalent 2016-2017 influenza virus vaccine in the U.S., does the committee recommend:
   A. Inclusion of an A/California/7/2009 (H1N1)pdm09-like virus
   B. Inclusion of an A/Hong Kong/4801/2014 (H3N2)-like virus
   C. Inclusion of a B/Brisbane/60/2008-like virus (B/Victoria lineage)

2. For quadrivalent 2016-2017 influenza vaccines in the U.S., does the committee recommend:
   A. Inclusion of a B/Phuket/3073/2013-like virus (B/Yamagata lineage) as the 2\textsuperscript{nd} influenza B strain in the vaccine